

What is claimed is:

1. An image display apparatus comprising:
    - a display device of a reflective type for displaying an image and reflecting illumination light fed thereto from ahead so as to produce image light representing the image;
    - an eyepiece optical system, disposed in front of the display device and composed of a rear portion nearer to the display device and a front portion farther from the display device, for directing the image light from the display device through the rear and front portions to a predetermined observation point so as to permit a virtual image of the image displayed by the display device to be observed at the observation point;
    - a light source, disposed in a position substantially conjugate with the observation point, for emitting the illumination light fed to the display device; and
    - a combiner, disposed between the rear and front portions of the eyepiece optical system, for introducing the illumination light from the light source into the rear portion of the eyepiece optical system in such a way that a path of the illumination light overlaps with a path of the image light,
- wherein
- the rear portion of the eyepiece optical system includes a refractive optical element having a positive power,
- the front portion of the eyepiece optical system includes a concave reflective surface, and
- the eyepiece optical system has an exit pupil behind and at a finite distance from the display device.

2. An image display apparatus as claimed in claim 1,

wherein the following relations are fulfilled

$$1 < f_a / f_t \leq 1.4$$

$$0.3 \leq E_{pd} / f_b \leq 0.9$$

where

- ft represents a focal length of the eyepiece optical system as a whole;
- fa represents a focal length of the front portion of the eyepiece optical system;
- fb represents a focal length of the rear portion of the eyepiece optical system; and
- Epd represents a distance from a rear end of the eyepiece optical system to the exit pupil of the eyepiece optical system.

3. An image display apparatus as claimed in claim 1,

wherein the concave reflective surface included in the front portion of the eyepiece optical system is a semitransparent reflective surface that partially reflects and partially transmits light, and is so disposed as to point to the observation point, and

the front portion of the eyepiece optical system includes a selective reflective surface that is so disposed as to face the concave reflective surface and that reflects or transmits light selectively according to a polarization direction of the light.

4. An image display apparatus as claimed in claim 3,

wherein the concave reflective surface included in the front portion of the eyepiece optical system is formed as a concave surface of a meniscus lens, and

the selective reflective surface included in the front portion of the eyepiece optical

system is formed on a flat surface of a member that has a flat surface and that transmits light.

5. An image display apparatus as claimed in claim 4,

wherein a convex surface of the meniscus lens included in the front portion of the eyepiece optical system is formed as an aspherical surface.

6. An image display apparatus as claimed in claim 5,

wherein the meniscus lens included in the front portion of the eyepiece optical system is composed of a concave surface side portion made of glass and a convex surface side portion made of resin.

7. An image display apparatus as claimed in claim 1,

wherein the refractive optical element having a positive power included in the rear portion of the eyepiece optical system is a planoconvex lens.

8. An image display apparatus as claimed in claim 1,

wherein the refractive optical element having a positive power included in the rear portion of the eyepiece optical system has an aspherical convex surface.

9. An image display apparatus as claimed in claim 1,

wherein the display device is a reflective liquid crystal panel, and  
the combiner is a reflective polarizing plate.

10. An image display apparatus as claimed in claim 1,

wherein an optical axis of the rear portion of the eyepiece optical system coincides with an optical axis of the front portion thereof,

the combiner is planar, and

an angle between an optical axis of the eyepiece optical system and a normal to the combiner is in a range from 30° to 40°.

11. An image display apparatus as claimed in claim 1,

wherein the rear and front portions of the eyepiece optical system each include a prism, and

the combiner is disposed between the prism included in the rear portion of the eyepiece optical system and the prism included in the front portion thereof.

12. An image display apparatus as claimed in claim 11,

wherein the prism included in the rear portion of the eyepiece optical system has a convex surface so as to be shared as the refractive optical element having a positive power.